Quantifying the Cost of Valve Leakage in Steam Lines

DIXON
The Right Connection®

Maintenance and reliability personnel know that reducing steam leakage is linked to a reduction of costs, so installing low leakage technology whereever possible makes sense.

Valve stem seal leaks are common in steam lines because thermal cycling tends to loosen the valve packing.

Eagle bellows valves are leak-free in steam service and are therefore a viable alternative to packed valves in a steam line.

Cost of Steam Production: Example

Consider a typical natural gas-fired boiler supplied with **230°F (110°C)** feedwater, producing **450 PSIG** saturated steam.[1] Natural gas cost: $1.54/MMBtu.

Cost of Steam

$$\frac{\frac{\$1.54/\text{MMBtu}}{10^6\ \text{Btu/MMBtu}} \times 1{,}000\ \text{lb.} \times 1{,}006\ (\text{Btu/lb.})}{.856} = \frac{\$1.81}{1{,}000\ \text{lb.}}$$

In this example, steam costs the facility $1.81 in fuel per 1,000 lbs. produced.

Cost of Valve Leakage: Example

Using the estimated cost of steam from above and the tables on the back, the cost of leakage is calculated below.

A valve in a **115 PSI** line that is throwing a plume of steam 3 feet at 90°F ambient temperature would yield a cost of:
(50 lb./hr.) x ($1.81/1,000 lb.) x (8,760hrs./year) = **$792.78/year**

A valve in a **115 PSI** line that has a packing leak approximated by a 1/16" hole would yield a cost of:
(15 lb./hr.) x ($1.81/1,000 lb.) x (8,760hrs./year) = **$237.83/year**

Considering all of the valves in a typical plant, the total savings would be significant.

Based on eliminating the cost of steam leakage as estimated above, a Eagle bellows sealed valve can pay for itself in a period of 1-2 years.

Consider the Eagle H8 or F8-series of valves for steam lines to reduce valve leakage costs. Dixon has a long history of supplying Eagle leak-free, bellows sealed valves for steam service.

Dixon provides actuation services for industrial and sanitary valves.

Eagle F8-Series Globe Valves

Eagle H8-Series Gate Valves

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Quantifying Valve Leakage

The Hole Size Method and Plume Length Method are used to estimate the amount of leaking coming from a valve.[2]

Hole Size Method

Steam Pressure (PSI)	Hole Size	Steam Loss (lb./hr.)
115	1/16"	15
115	1/8"	60
115	1/4"	240
115	1/2"	1,010
115	1"	3,900
415	1/16"	55
415	1/8"	220
415	1/4"	880
415	1/2"	3,520
415	1"	14,080

Plume Length Method

Plume Length	Steam Loss (lb./hr.)		
	45°F Ambient	70°F Ambient	90°F Ambient
115 PSIG			
3 ft.	10	30	50
6 ft.	30	170	280
9 ft.	70	420	700
12 ft.	110	650	1,100
415 PSIG			
3 ft.	20	35	50
6 ft.	50	170	290
9 ft.	130	500	800
12 ft.	220	870	1,400

References
1. US DOE. (2012). Steam Tip Sheet #15: Benchmark the Fuel Cost of Steam Generation. Retrieved from https://www.energy.gov/sites/prod/files/2014/05/f16/steam15_benchmark.pdf
2. CIBO. (1997). CIBO Energy Efficiency Handbook. Burke, VA: Council of Industrial Boiler Operatorw. Retrieved from https://www.energy.gov/sites/prod/files/2014/05/f15/steamhandbook.pdf

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